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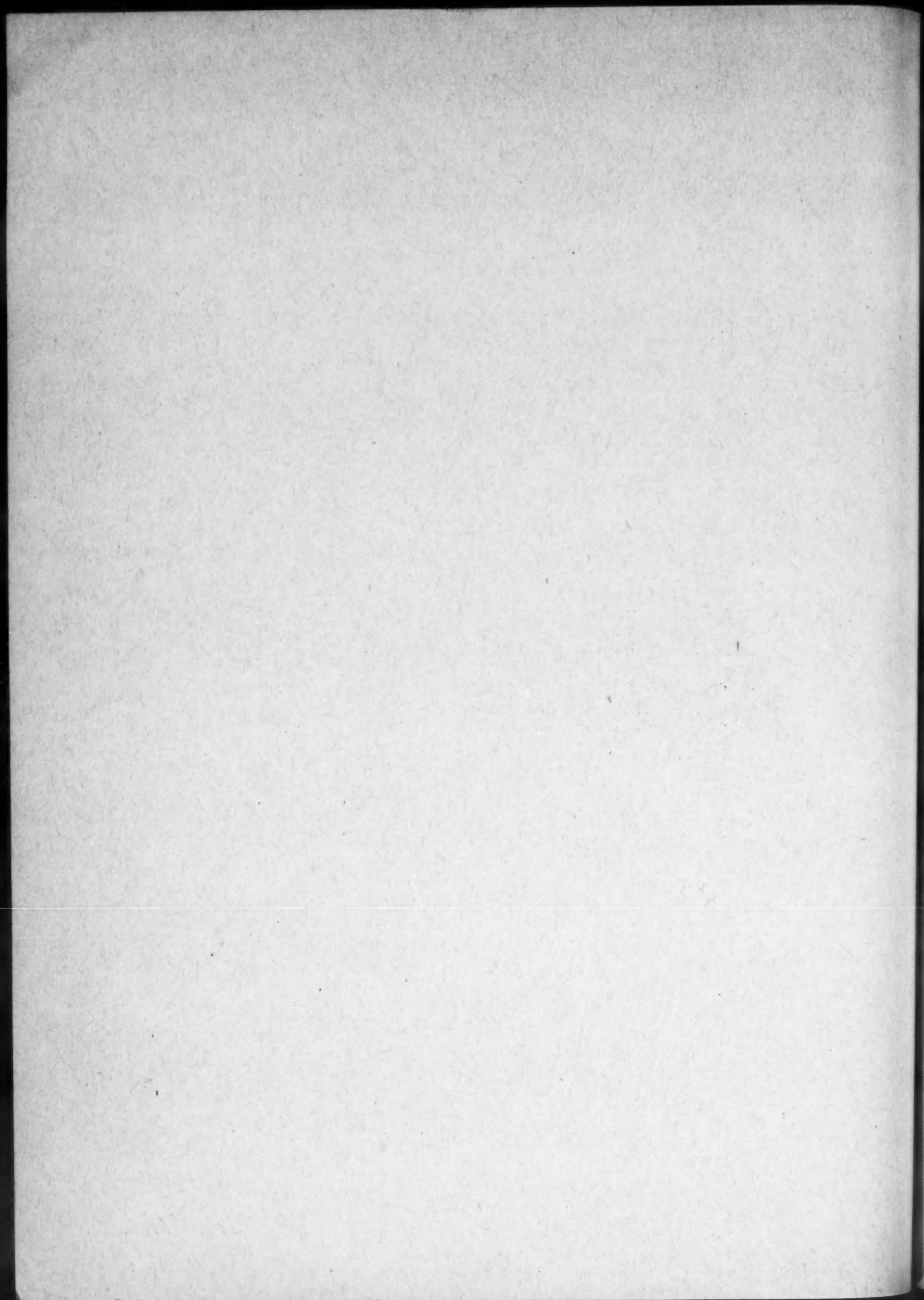
# AGRICULTURAL NEWS LETTER

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JULY-AUGUST, 1942

This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations of the du Pont Company and its subsidiary companies. It also contains published reports and direct contributions of investigators of agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.





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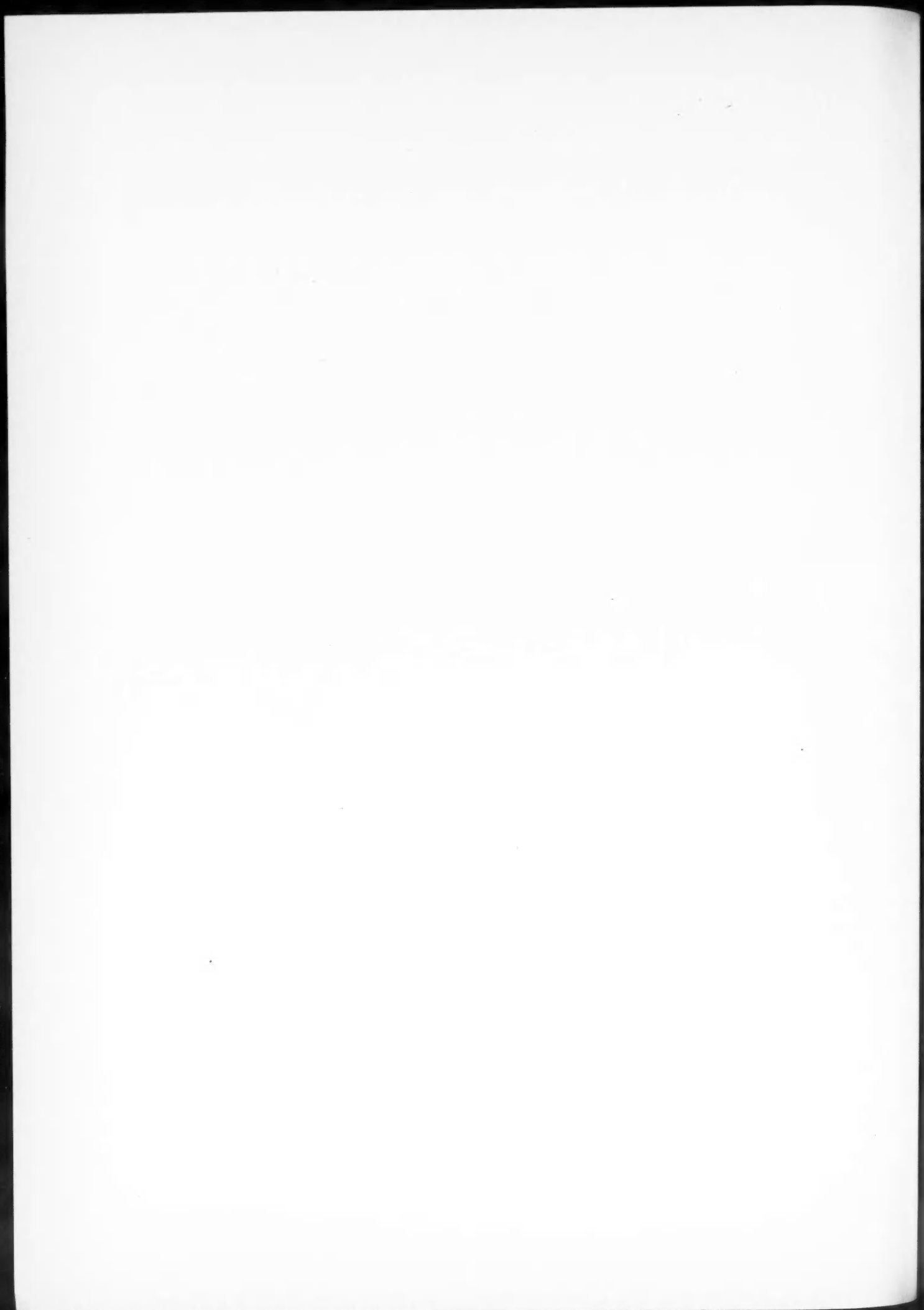
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CHEMISTRY HELPS FARMER PRODUCE UNPRECEDENTED AMOUNTS  
OF WARTIME FOOD, FEED, FIBERS, AND FATS

The American farm today is an important "second front" in the war against the Axis. The United States is not only the military arsenal of Democracy, but the agricultural arsenal and granary for all the United Nations, as well. This country is the chief and in many instances almost the sole source of stupendous quantities of food, feed, fiber, and fats — all essential to the successful conduct of the war.

During the first months of our actual participation in the war, American agriculture, as well as American industry, has been mobilized for total war. Immediately after Pearl Harbor, Secretary of Agriculture Claude Wickard clearly defined the objectives when he said that the nation looks to the farmers of this country for enough production this year to feed and clothe our own people for their wartime task and, in addition, for indispensable supplies of food and fiber for the people and fighting forces of all the United Nations. He emphasized the fact that "adequate farm production is vital to the nations existence," and that the task of achieving it would command the energy and devotion of every farm family. He made it quite clear that "this is an all-out program difficult of attainment."

Farming at one time was largely a matter of planting, cultivating, harvesting, and, to a considerable extent, the actual consumption and utilization of the crops and livestock produced.

Today it involves much more — longtime planning, rotating and fertilizing to improve quality and increase yields, fighting insect pests and diseases of both plants and animals, marketing, and more immediately the proper utilization of all available chemicals, farm equipment, and other facilities to produce from the same acreage unbelievably large amounts of food and raw materials essential to the successful prosecution of the war.

In this modern conception of mechanized and scientific farming, now underscored by the immediate urgency of the problems of supply brought about by the unprecedented war demands, the synthetic chemicals industry looms large. This chemicals industry has been built under a system of free enterprise, largely since the first World War, on the results of long years of painstaking and forward-looking experiments, and much financial risk.

Much of this research has been with chemicals and chemical compounds designed exclusively or primarily for use on the farm. This fundamental research is not being abandoned, but on every program of fundamental research being conducted by private industry today is superimposed an applied-research program, streamlined to meet immediate war requirements.

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When we think of the farmer and of the chemicals he uses on the farm, fertilizers, insecticides, and fungicides come at once to mind. Without these, many farming operations would be unproductive, if not impossible. Without fungicides to treat his seed against fungus diseases, and insecticides to control pests, the farmer would find whole crops destroyed or so damaged that they would be largely unmarketable.

Fertilizers actually produce, on the average, 15 per cent of our farm crops. Their effects on maturity, quality, and marketability are untold. Fertilizers produce a much larger proportion of some crops. For instance, something like a third of our tomato crop simply would not be grown if no fertilizer was applied, and the quality of the two-thirds that was produced would be decidedly inferior.

Without fertilizers, production of citrus fruits in Florida might fall off as much as 80 per cent. Most fertilizers contain nitrogen, phosphoric acid, and potash. Before and during the first World War we were almost entirely dependent on foreign sources for our nitrogen and potash and for some of our phosphates. Today large quantities of nitrogen extracted from the air are being supplied by the American chemical industry not only to agriculture, but to the government for use in the manufacture of military explosives as well; and, of course, it is known that capacities are being enlarged to meet the increased demands of all-out war. Domestic supplies of potash, privately developed by American producers, are meeting the needs for this important ingredient of fertilizers and other essential war materials, and large amounts of phosphates are being mined in various parts of the country.

It is almost impossible to name a chemical or a chemical compound that does not have some place in farming operations. Take a common element like zinc. It is used in such farm items as power equipment, galvanized roofing, sprays, paints, dairy and poultry equipment, sugar refining, fencing, fertilizers, and even the fruit jar cover which conserves the products of garden and orchard.

Again consider urea. Its best-known farm use is as nitrogen fertilizer. It also supplies protein feed for cattle, sheep, and other ruminants; controls weeds in tobacco seed beds; helps control nematodes in horse barns; has medical values of special interest to the veterinarian; is useful in making compost for mushroom growing; and is finding favor in seasoning timber and bending raw wood.

The Navy has been an important user of urea-treated wood for numerous purposes where seasoned lumber, not subject to checking, is required. The Army, too, is purchasing large amounts of treated lumber for use as stringers, planks, and rails on army pontoon bridges. Without chemical seasoning, it would have been almost impossible for the industry to supply the Government with all the pontoon lumber asked for on Army specifications.

Some mills that tried to dry this material without chemical aid experienced seasoning degrades of 40 to 60 per cent of the stock dried, and in addition

Continued on next page

tied up their dry kilns for an unreasonably long time. These seasoning difficulties were solved by the use of urea, and kiln degrade of this important farm crop was reduced to around 3 per cent.

The farmer can grow and store greater crops for wartime use if he has chemical fumigants to kill mice and rats. Use of ammonium sulfamate kills noxious weeds; hormones increase yields by enabling the farmer to pick his apples and other fruit at the peak of their marketability, instead of having them drop to the ground to become worthless; phenothiazine eliminates worms from livestock; activated animal sterols in poultry feed supply Vitamin D for sound bone development and normal growth of chickens; isobutylundecylenamide supplements pyrethrum, an insecticide ingredient which came almost exclusively from Japan and Kenya Colony, in household and cattle sprays; calcium hypochlorite prevents spread of bacterial ring rot and other storage diseases of potatoes disseminated in the wash water when potatoes are washed for market. Then there are chloropicrin, carbon bisulphide, ethylene dichloride, methyl bromide or ethyl mercury iodide, all of which have been used successfully to control the root-knot nematode in the soil; methyl bromide as a fumigant and control of codling moth and even of rattlesnakes; diphenylamine as a wound protector against screwworm; formaldehyde for fumigation of mills and various farm storage houses and for sterilization of greenhouse soils; hydrocyanic acid gas for fumigation of farm buildings and for control of citrus insects. Numerous additional examples will suggest themselves to anyone familiar with farming during recent years.

### Chemurgy

Chemistry also opens a large and scarcely touched field in the use of farm materials in industry to produce plastics and other materials of utmost importance to our war effort.

Two war "essentials" are smokeless powder and glycerin — both stemming from the farm. Smokeless powder is based on nitrocellulose, and of course, cellulose comes from farm-grown cotton and wood. Dynamite, a commercial rather than a military explosive, is aiding in building highways, tunnels, canals and harbors, and speeding up the mining of coal and vital metals. This commercial explosive is a combination of ingredients of which nitroglycerin is a part; and glycerin is derived from vegetable and animal oils from the farm.

Thousands of individual articles, many now restricted to wartime uses, are made of plastics. One of the main ingredients in many plastic materials is farm-produced cellulose. An important plastic finding a wartime application contains camphor, chemically made from the turpentine taken from southern pine.

Few people think of photographic film as derived from a farm product. However, this item is also made from cellulose. In addition, a highly essential part of this film is gelatin, derived from the hides and hoofs of cattle.

Every plant grown on our farms today may be a potential source of industrial cellulose when research gets its chance to experiment and evaluate.

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Chemurgy is in its infancy; yet during 1941 numerous new uses of farm products were discovered. For instance, ursolic acid was derived from cranberry skins, and cranberry seed oil was found to be a source of Vitamin A. Grape seeds were found to be a source of an oil for textile and leather finishing. Shredded redwood bark was used for house insulation because of its fire-resistant qualities. Soybean wool was developed. Soybean oil was successfully used in road-marking paints. Plastics and soap were made from coffee. Various farm plant, such as the Guayule plant, were reported as a source of rubber. Cotton was utilized in the manufacture of paper. Osage orange-tree extract was used to tenderize beef. Briar pipes were made from ivy, laurel, and rhododendron burls. Casein was used in paints and in oil-well drilling. Many products were made from milkweed. Oxalic acid was produced from sawdust. Plastic helmets were made from soybeans and cotton. A new plastic was made from sugar-cane fiber.

So the market for farm products which, when processed, become war materials, becomes greater and greater. The large chemical companies use many millions of pounds of vegetable oils; corn products; wood pulp; turpentine and pine rosin; linters and purified cotton; cotton fabrics and yarn; and similar farm products for chemical consumption. The price these companies pay for these farm products runs into many millions of dollars.

Here then is an American industry which produces for the farmer the many chemicals he requires to operate his farm successfully, and at the same time buys from the farmer quantities of his produce for ultimate use in prosecution of the war.

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#### NEW MATERIAL GIVES UNIFORM COVERAGE OF LEAD ARSENATE

A new material which gives a uniform film coverage of lead arsenate is being introduced by Du Pont in limited quantities in areas where adequate codling moth control demands both smooth and heavy deposits. This product, known as "Alkote" spray load builder, can be used alone with standard acid lead arsenate or in combination with certain summer oil sprays. Experiments now in progress show that this new spray load builder is compatible with other pesticides such as low-solubility copper compounds, nicotine sulphate, ground derris, timbo, barbasco, cube, and many wettable sulphurs.

Further information will appear in a subsequent issue of the "Agricultural News Letter."

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PHENYL MERCURY OLEATE PREVENTS MILDEW IN EXPERIMENTS ON TENTS  
USED TO FUMIGATE FOR CONTROL OF INSECT PESTS OF CITRUS

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From time to time we discuss new developments involving chemical compounds which, because of the war, are not at the moment available in sufficient quantities for normal commercial use. Information of this character is included because the results of research must be considered in terms of their long-time application, rather than of their immediate use. Such is the report that follows.

Most chemical treatments that are effective protection of various fabrics against mildew infection are not practical for application to tents used by California citrus growers to fumigate with hydrogen cyanide for control of scale insect pests. They usually fail in one or more essential requirements.

However, recent experiments have shown that phenyl mercury oleate is an exceptionally efficient compound for control of mildew because it has the highest possible antiseptic efficiency, is water insoluble and accordingly does not leach out of the fabric, is relatively non-volatile, and does not react with hydrogen cyanide to impair its effectiveness or cause injury to trees being fumigated. In addition, it does not close up the pores of the tent nor affect its pliability. It does not greatly increase the weight of the tent because very low concentrations are effective. It has no detrimental action on the fibers of the canvas, and is relatively free from industrial health hazards. It is simple to apply, and inexpensive for efficient and lasting protection.

From the standpoint of antiseptic efficiency, tests conducted by A. F. Swain and J. K. Primm, of the Du Pont Company's El Monte laboratory, have shown that the application of 0.2 pounds of phenyl mercury oleate to 100 pounds of fabric (a 45-foot tent weighs from 100 to 110 pounds) will prevent infection by mildew fungi for two or more seasons, if the canvas is properly cared for after treatment. They report that several hundred tents treated in the fall of 1941 were used throughout the winter with no indication of injury to fabric. Trials made during the spring, summer, and fall of 1941 showed no injurious effects on the trees.

Persons handling the concentrated emulsion made from Du Pont's "FD-2" fungicide, an emulsifiable oil containing 10% phenyl mercury oleate, should observe normal precautions taken with any organic mercury compound. For instance, operators applying the material to fumigation tents as a spray under pressure should protect themselves from breathing the vapors by use of respirators.

A Simple Method of Applying To New Canvas

With new canvas not yet made up into tents, a simple method is to run the cloth through an oil and water emulsion of phenyl mercury oleate. One fumigation operator used a galvanized tank about three feet square and 18 to 20 inches high;

Continued on next page

horizontal to and about 1/4-inch above the bottom of which were soldered two 1/2-inch pipes a foot or more apart. Above the tank was secured a windlass. To operate it, the end of a bolt of canvas was fed beneath the pipes in the bottom of the tank in which there was an emulsion of phenyl mercury oleate, and then slowly wound up on the windlass. The canvas was left in the roll overnight to become thoroughly saturated, and next day it was unrolled and dried. In a test run, four pounds of "FD-2" were mixed with 20 gallons of water in the tank. After 500 yards of the canvas were run through, less than a gallon of emulsion was left. In this manner, 0.2 pounds of phenyl mercury oleate were incorporated into 95 pounds of canvas.

#### How to Apply to Tents Already Made Up

To apply to tents already made up, spread the tent on a flat surface, preferably pavement. Spray it with the proper strength emulsion. Place a second tent on top of that one, and spray it. Repeat until 20 or 30 tents are in the pile. Leave overnight; remove next day, and spread singly to dry. Approximately 10 pounds of "FD-2" to 100 gallons of water will leave two pounds per 100 pounds of fabric, or 0.2% by weight of phenyl mercury oleate, impregnated in the canvas.

#### How to Prepare An Oil-In-Water Emulsion With "FD-2"

Before adding the "FD-2" to the measured quantity of water in the mixing tank, first mix the required quantity with an equal volume of water (temperature between 60°F. and 100°F.) and stir thoroughly. After stirring until a smooth cream is produced, add another volume of water and again mix thoroughly. Continue adding water and mixing thoroughly until a total of six volumes of water have been added. Then pour this concentrated emulsion into the measured quantity of water, having a temperature of between 60°F. and 100°F. Mix thoroughly by mild agitation.

If the emulsion shows a tendency to break, and oil separation is noticeable, it usually can be prevented by putting a little "Gardinol" fatty alcohol sulfate or similar type of wetting agent in the water in the mixing tank before the "FD-2" is added.

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#### PLASTIC HELPS PROTECT MILK FROM GERMS

Germs and condensed moisture can be prevented from entering milk cans while they are being filled in dairies by use of a new can-filling unit with a transparent cover molded of "Lucite" methyl methacrylate resin produced by Du Pont. The plastic cover seals completely the mouth of the can, but allows the dairyman to see the level of the milk without exposing it to the air. The cover is cleaned easily and resists cracking or chipping.

Designed to drain any condensed moisture on the feed-line to the outside of the can, the unit has a valved feed-tube built snugly into the cover to carry the milk directly from the feed-line into the can.

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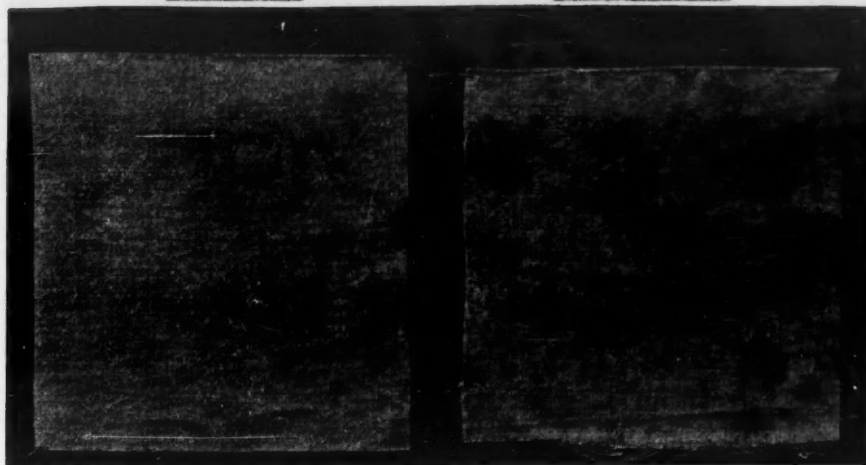
MILDEW PREVENTION ON FUMIGATION TENT CANVAS AND DUCK

Experiments Show That 0.2 Pounds of Phenyl Mercury Oleate Applied to 100 Pounds of Fabric Will Prevent Infection From Mildew for Considerable Time.

LIGHT-WEIGHT CANVAS

Treated

Untreated

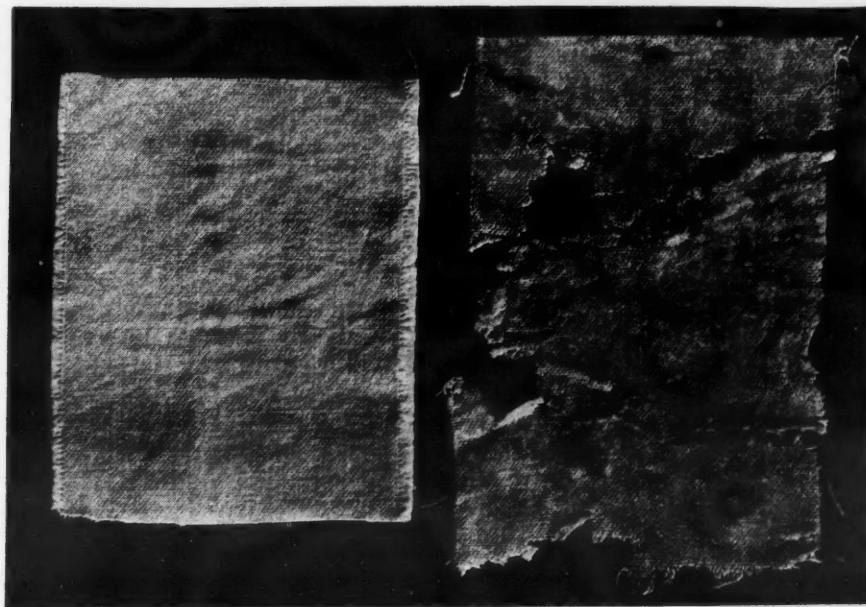


Appearance after 2 weeks' exposure in contact with absorbant tissue at 80° F. Cloth on left treated with 0.1% phenyl mercury oleate.

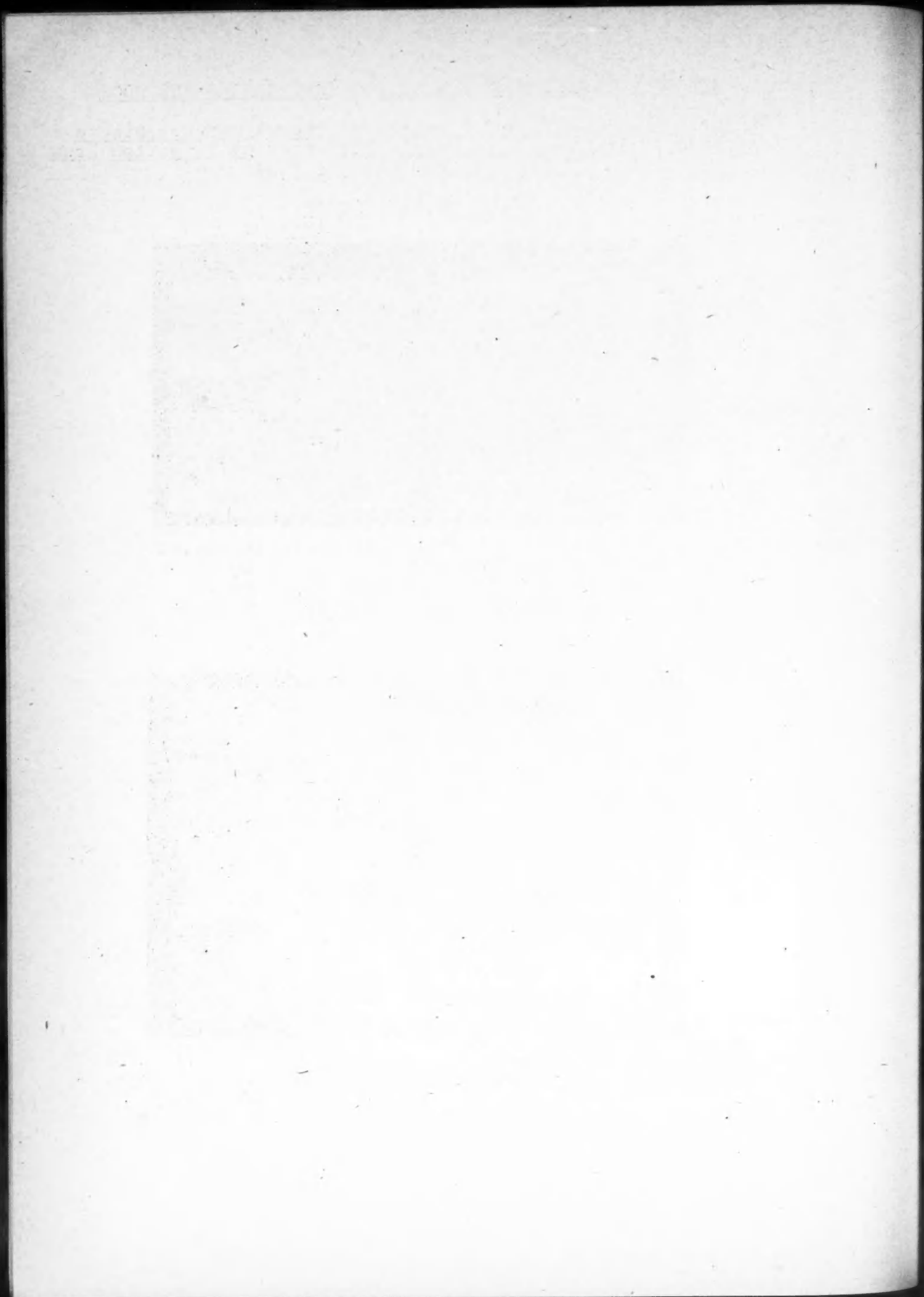
EIGHT-OUNCE U.S. ARMY DUCK

Treated

Untreated



Appearance after being buried in damp soil 18 days. Cloth on left (treated with 0.2% phenyl mercury oleate) lost some tensile strength, but untreated had almost completely deteriorated.



### DERIVATIVES OF DITHIOCARBAMATE AS PESTICIDES

The following article is a brief summary of the interesting results obtained with derivatives of dithiocarbamic acid. Following the original discovery of the effectiveness of these products by the Du Pont Company in 1931, extensive research has resulted in the development of two promising fungicides - ferric dimethyl dithiocarbamate, produced by the Du Pont Company, and tetramethyl thiuram disulfide, a product of the Bayer-Semesan Company. These new fungicides are now available under the trade-marks "Fermate" and "Thiosan," respectively. Extensive investigations are being continued with other derivatives of dithiocarbamic acid to determine their effectiveness for various pesticidal uses.

By Dr. W. H. Tisdale and  
Dr. A. L. Flenner  
Du Pont Pest Control Laboratory  
Wilmington, Delaware

Investigations by the Du Pont Company in 1931 showed some of the derivatives of dithiocarbamic acid to have insecticidal and fungicidal value. Some of the alkyl derivatives, including the methyl and ethyl derivatives, appeared to be most promising. The thiuram sulfides and the metal dithiocarbamates were of special interest. More extensive investigations since that time have developed further valuable information on the efficiency of these products as insecticides and fungicides, and have shown some of them to be toxic to mites and highly toxic to the protozoan causing cecal coccidiosis of poultry. A marked degree of specificity is shown by members of this group of organic sulfur compounds on the different kinds of pests. Substitution of one or both alkyl groups by aryl groups has been shown to lower the fungicidal efficiency. Some of those with only alkyl groups are sufficiently outstanding in effectiveness for certain specific purposes to justify some optimism with regard to their practical use. As is true with many sulfur compounds, the thiuram sulfides have shown a tendency to cause dermatitis on a low percentage of humans. The derivatives tested have proved to be unusually free from injury to plant life.

#### Fungicidal Efficiency

Laboratory evaluations with the thiuram sulfides and thiocarbamates indicated that there was a wide range of difference in the toxic action of different members of these groups under the conditions of the experiments. Water and nutrient agar media were employed. Sodium dimethyl dithiocarbamate was the most effective of these chemicals when applied in water to the spores of Ustilago hordei (covered smut of barley). A dilution of this chemical (1 to

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30,000) in water was highly effective in killing spores of the fungus. Tetramethyl thiuram monosulfide was effective in twice the foregoing concentration. The derivatives of a lower degree of water solubility proved less effective in these tests. These compounds were less effective against Fomes annosus and Aspergillus niger when incorporated in nutrient media which were inoculated with mycelium of these fungi. The metal derivatives showed a low degree of effectiveness in such laboratory tests. Solubility and possibly stability may have contributed to the results, the more soluble and less stable compounds showing higher efficiency.

Experiments on Tricodonyton sp. and other fungus infections of the skin showed tetramethyl thiuram monosulfide, tetraethyl thiuram monosulfide, and sodium dimethyl dithiocarbamate to be effective in low concentrations. The first of the three was used on a larger number of cases in a concentration of 0.8 per cent in alcohol solution and resulted in slightly over 90 per cent cures. Approximately 2 per cent of these cases developed a dermatitis, in most cases slight, which was attributed to the treatment.

Field investigations in the control of fungus diseases of plants have developed some interesting results which tend to emphasize the specific action of these compounds. Tetramethyl thiuram disulfide has proved to be highly effective for the control of tulip fire, Botrytis tulipae, in Europe. It is effective for the control of apple scab, Venturia inaequalis. Harrington (4) reported this compound to be effective for the control of turf diseases.

Limited experiments have shown that tetraethyl thiuram monosulfide, when used in water emulsion in 0.2 per cent concentration, is effective for the control of rose mildew.

Ferric dimethyl dithiocarbamate has shown a high degree of fungicidal efficiency when used as a spray against cherry leaf spot (Coccomyces hiemalis) and brown rot of stone fruits, and has shown promise against Venturia inaequalis when used in concentrations of 1 to 1.5 pounds in 100 gallons of spray solution. The product is extremely finely divided and adheres to fruit and foliage exceptionally well without assistants. In combination with lime it has shown greater fungicidal efficiency in some cases, and the combination is lighter in color, which is desirable on light colored fruit and flowers. There is probably a slow reaction, resulting in the formation of calcium dimethyl dithiocarbamate which is water soluble and effective.

#### Insecticidal Efficiency

Although none of the derivatives of dithiocarbamic acid have proved effective as stomach poisons, some of the thiuram sulfides, especially tetramethyl thiuram monosulfide and tetraethyl thiuram monosulfide, have proved of interest as contact poisons on soft-bodied insects when used in suitable solvents. When tetraethyl thiuram monosulfide was mixed with equal parts of vegetable oil and emulsified in water, it was effective on Aphis rumicis and several other species of aphids.

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Insect feeding inhibitors have taken on greater significance in this country with the spread of the Japanese beetle, Popillia japonia. These beetles occur in such enormous numbers that, if nonrepelling poisons are used, the plants will be damaged while the beetles are eating enough to poison them. A product that prevents feeding protects the plants even though the beetles are not killed. We discovered in 1931 that tetramethyl thiuram monosulfide prevented the feeding of tent caterpillars on wild cherry foliage.

In cooperative experiments by the Delaware Agricultural Experiment Station and the Du Pont Company from 1933 to 1937, Guy (2) showed that, of a large number of chemicals tested, including many derivatives of dithiocarbamic acid, tetramethyl thiuram disulfide was the most effective feeding inhibitor of the Japanese beetle and the Mexican bean beetle, Epilachna varivestris. On a unit weight basis it was more than three times as effective as arsenate of lead and more effective than ground derris root containing 4 per cent rotenone. Under field conditions this high efficiency rating has been difficult to obtain because of the physical properties of the product which make it difficult to maintain adequate coverage of the foliage during heavy rains.

In 1938 Dietz and Pierpont (1) made extensive field trials on peaches and apples. They found that tetramethyl thiuram disulfide with suitable conditioning agents and a combination of this compound with ground derris in equal proportions were the outstanding Japanese beetle feeding inhibitors. They pointed out the desirability of applying beetle sprays in advance of heavy infestation if best results are to be obtained.

Guy and Dietz (3) in 1939 reported results of field experiments on Japanese beetle with an improved formulation of tetramethyl thiuram disulfide which adhered much better to the foliage of plants. This product was again the outstanding feeding inhibitor. Two and one half pounds of an 80 per cent mixture was more effective than 4 pounds of ground derris root containing 5 per cent rotenone.

Guy (2) found ferric dimethyl dithiocarbamate to be highly effective for inhibiting the feeding of Mexican bean beetles and Japanese beetles. More extensive field experiments conducted by the Du Pont Company during 1940 and 1941 showed this product to be equal, if not superior, to tetramethyl thiuram disulfide as a Japanese beetle feeding inhibitor. It is an extremely finely divided product and adheres unusually well to fruit and foliage without added assistants. This property, in addition to the fact that it has high fungicidal value, makes it appear promising.

Why tetramethyl thiuram disulfide prevents feeding of Japanese beetle has been investigated. Various theories have been advanced. Such factors as odor, taste, and irritation of the body parts were commonly suggested. It was found that by preparing leaves of favorite Japanese beetle food plants with alternate treated and untreated bands across them the beetles would light on the leaves and crawl around as usual, but refuse to eat even the untreated areas. Beetles were dusted with the powdered material and then placed on clean plants where they refused to feed. Beetles placed on treated plants and then removed to untreated plants likewise refused to feed. It was noted that the beetles which

Continued on next page

had contacted the chemical showed partial paralysis of the forelegs and mouth parts. This paralysis appears to be connected with the refusal of the Japanese beetle to feed after contacting tetramethyl thiuram disulfide.

#### Control of Skin Infections

A number of the derivatives of dithiocarbamic acid have been found to be toxic to mites that infest plants and animals. Tetramethyl thiuram and tetraethyl thiuram monosulfides proved to be the most effective of these compounds for the treatment of animal skin infections. The latter is especially promising because of its high oil solubility. It can be diluted with oil and emulsified in water for use, and thus the use of objectionable solvents is avoided which are required with the methyl compound. A 1.25 per cent tetraethyl thiuram monosulfide emulsion is proving highly effective for the control of certain fungus and bacterial skin infections of dogs.

#### Cecal Coccidiosis of Poultry

In cooperative experiments supported by the University of Wisconsin and the Du Pont Company, Herrick, Holmes, and Degiusti (5) investigated ten organic sulfur compounds, including four derivatives of dithiocarbamic acid, for the control of cecal coccidiosis of chickens caused by Eimeria tenella. Of the ten compounds investigated, "Lorol" fatty alcohol thiocyanate and tetramethyl thiuram monosulfide were effective in providing protection against infection. The latter in unadulterated form was apparently the most satisfactory, for it was the least toxic to chickens. Dosages of 0.0003 mg. per gram body weight of this product were effective. These products were more effective if given several hours before the oocysts were fed. Single doses were effective in preventing the development of cecal coccidiosis in chickens. Continuous feeding of these chemicals under the conditions of the experiments proved unsuccessful. However, further research might result in a satisfactory means of administration in the feed.

Tetraethyl thiuram monosulfide, fed in suitable small dosages at the time of the administration of coccidia oocysts, offers promise for developing resistance to coccidiosis in chickens. Further research is needed to develop a practical method of application of the chemical and the oocysts to produce resistance.

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NOTE: Sufficient quantities of tetraethyl thiuram monosulfide for further experiments with poultry will be sent to qualified research workers, upon request.

"FERMATE" CONTROLS DOWNY MILDEW IN TOBACCO SEED BEDS

Because fumigating tobacco seed beds to control blue mold or downy mildew has certain drawbacks, Dr. P. J. Anderson, plant pathologist in charge of the Tobacco and Vegetable Substation at Windsor, Conn., tested many materials in his search for a simple but effective spray material to do the job.

Experiments on four crops of tobacco plants last winter in the greenhouse and in seed beds in the spring of 1942 demonstrated that ferric dimethyl dithiocarbamate (recently given the trade-mark "Fermate" by Du Pont) will give 95 to 100 per cent control.

Dr. Anderson points out that although benzol or paradichlorobenzene, properly used, will give excellent control, the fumigation method has certain drawbacks. The seed beds must be very tightly constructed to prevent escape of the gas. However, since many seed beds are not so constructed, growers waste their time and money without getting control. The paradichlorobenzene method is also quite dependent on temperature, and does not give sufficient evaporation at low temperatures. Benzol is inflammable and, if splashed on the leaves, causes dead spots. Both substances must be applied at night, which is often very unsatisfactory.

Dr. Anderson has tested a large number of compounds during the last four years, but until about six months ago, failed to find a satisfactory one. However, last winter he discovered that best control was obtained with a solution of  $1\frac{1}{2}$  to 2 grams of "Fermate" in a liter of water (corresponding to approximately  $\frac{1}{2}$  to  $\frac{2}{3}$  of an ounce in  $2\frac{1}{2}$  gallons of water), with the addition of the same amount of lime as "Fermate."

The tobacco plants were sprayed with this solution twice a week. Dr. Anderson feels that further experiments will probably show that longer intervals or different dosages are equally good. During some of the tests there was a little leaf injury (chlorotic spots) from the spray, but this was never serious.

Equally good control was obtained with sodium dimethyl dithiocarbamate, but this injured the plants some and was therefore not used in further trials.

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FERTILIZED PONDS SUPPORT 4 OR 5 TIMES AS GREAT A WEIGHT  
OF FISH AS UNFERTILIZED PONDS

The most important problems involved in raising fish in farm ponds are the production of food and the management of the fish population so that the correct number of fish are present to utilize efficiently the food produced, according to the Alabama Agricultural Experiment Station.

Fertilization of pond waters is the only practical method known by which the weight of fish that a pond can support may be materially increased. Fertilized ponds in Alabama support four or five times as great a weight of fish as unfertilized. In experiments in that State, ponds stocked with 1500 bluegills per acre and fertilized with a fertilizer containing nitrogen, phosphorus and potassium gave yields of 500 to 600 pounds of fish per acre, while the average unfertilized pond, similarly stocked, produced only 40 to 200 pounds. The average size of the fish from the fertilized pond was 4 ounces, and from the unfertilized 1.1 ounces.

After the fish used in stocking a pond have spawned once, more small fish are present than can adequately be supported by the food which the pond is producing. Hence, a pond rapidly reaches its maximum carrying capacity, usually within one year. If the number of fish in a pond remains the same after the first year, an increase in the average size of these fish is impossible unless the food supply is increased.

Pond-fish live mainly on microscopic water-animals, water-insects, and small fish, most of which in turn use microscopic plants for food. These plants, while present in most ponds, are so small in size and in number that they cannot be seen. When the pond is fertilized with a complete fertilizer of the grade normally used to fertilize field crops such as cotton or vegetables, the microscopic plants in the water grow and multiply so rapidly that the water appears green or brown. Thus, the reasons for fertilizing a pond and a pasture are essentially the same. Both are fertilized to produce more plants - to produce more or larger animals, but in one case the animals are fish and in the other they are livestock.

Fish-pond management, however, involves much more than proper use of commercial plant food. H. S. Swingle, fish culturist, and E. V. Smith, associate botanist, in Alabama Experiment Station Bulletin No. 284, discuss the general principles of pond management, proper stocking of new ponds, methods of stocking, sources of fish for stocking, management of old ponds, fishing, and control of weeds and mosquitoes.

Kinds and Amounts of Fertilizer Per Acre

The Alabama investigators recommend adding to an acre of water at each application 100 pounds of a fertilizer containing 6 per cent nitrogen, 8 per cent phosphorus, and 4 per cent potassium. If nitrate of soda is available, they suggest 10 pounds may be mixed with the 6-8-4, or applied separately.

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APPLYING FERTILIZER TO SMALL POND



Broadcast from bank over shallow parts of pond.

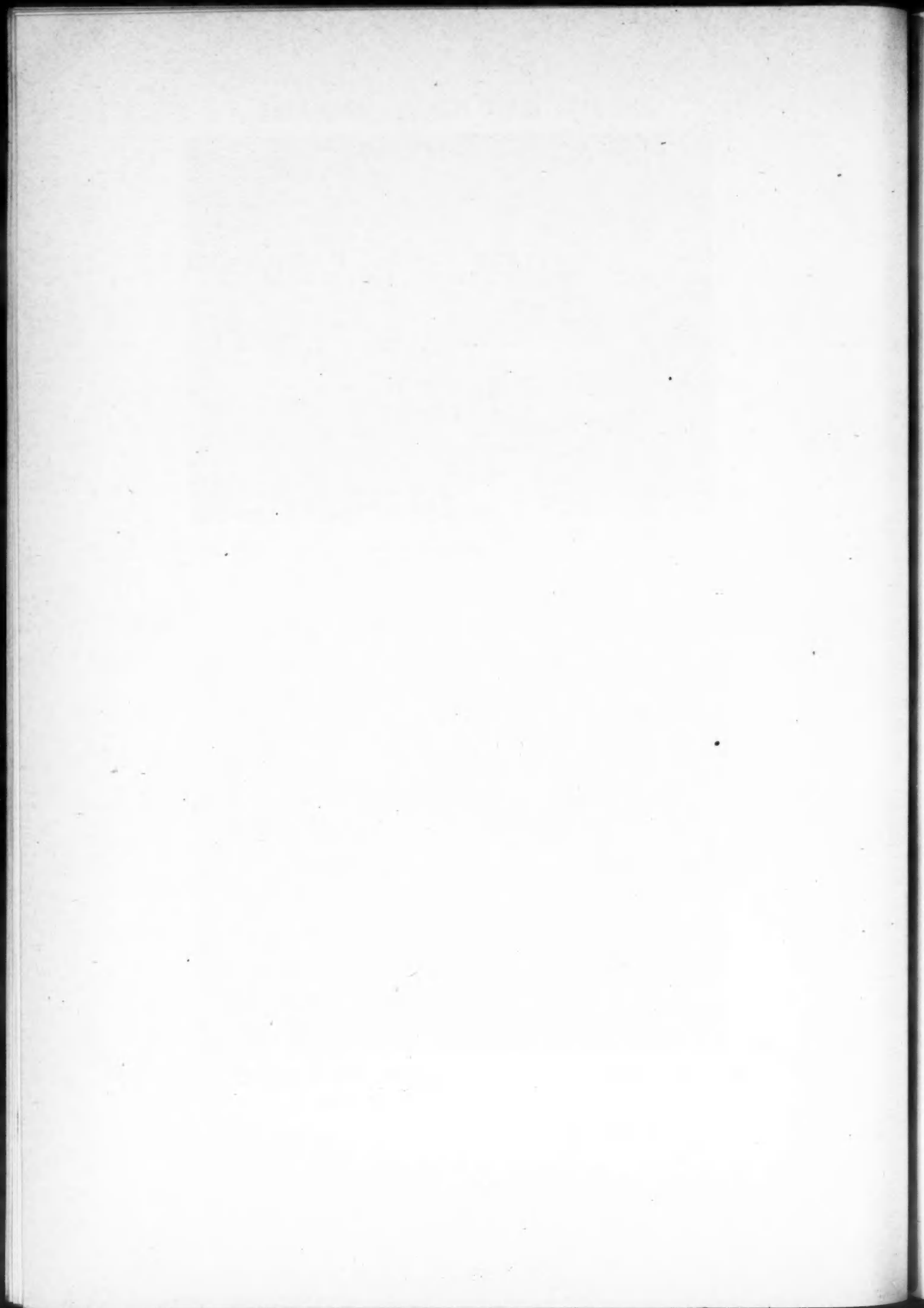
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AVERAGE WEIGHT FROM FERTILIZED AND UNFERTILIZED PONDS



Upper -- Fertilized  
4 ounces

Lower -- Unfertilized  
1.1 ounces



### Time and Frequency of Application

Swingle and Smith state: "If the pond does not receive flood-water, the first application of fertilizer should be made during the first warm weather of spring (usually March in Alabama). When a pond receives appreciable amounts of flood-water, fertilization should be delayed in the spring until danger of floods is past (usually April or May in Alabama). Within a few days after an application, the water should become murky and appear green or brown due to the growth of microscopic plants. Subsequent applications should be made whenever the water begins to lose this green or brown color and becomes clear enough for the bottom to be seen in  $1\frac{1}{2}$  or 2 feet of water; this usually requires an application every 3 or 4 weeks. The last application should be made in September or October, the ponds thus receiving between 8 and 14 applications per year. The annual cost per acre will vary from \$11 to \$20.

"The use of only 1 or 2 applications of fertilizer per year will not give good results. One application of fertilizer results in an increase in fish food lasting for approximately 1 month. This causes a temporary increase in the weight of fish which the pond carries. If the pond is not again fertilized, the food supply gradually decreases, and the weight of fish which the pond can carry decreases accordingly. For best results, a pond must be fertilized periodically throughout the growing season in order to maintain an adequate food supply during this period. Ponds having the least amount of over-flow water require the least fertilizer; similarly, those receiving water from fertile land require less fertilizer than those receiving water from poor land.

### Method of Applying Fertilizer

"For small ponds, the fertilizer should be broadcast from the bank over the shallow parts of the pond. No attempt need be made to cover the pond completely as wave action may be depended upon to distribute the microscopic plants produced. For large ponds, the sacks of fertilizer should be carried in a boat equipped with a motor. The fertilizer should be poured slowly from the sacks as the boat is moved back and forth over the areas where the water is from 1 to 6 feet deep."

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### DISAGREEABLE MOLD IN TOBACCO CAN BE GREATLY RETARDED

Moisture which adds "juice" to chewing tobacco and flavor and freshness to pipe and roll-your-own cigarette tobacco also encourages disagreeable mold growth at warm humid temperatures. However, by adding to the tobacco a small quantity of an inhibitor, mold growth in prepared tobaccos is delayed three months and longer, according to chemists at the Du Pont Company's Food Research Laboratory.

One to two pounds of propionate salts to 1,000 pounds of tobacco postpones molding three times longer than if there were no inhibitor. The retardant usually is mixed in the "casing liquor" with which tobaccos are treated.

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FORMULA NO. 62 - NEW REMEDY FOR SCREWORM IN LIVESTOCK

The U. S. Dept. of Agriculture, in announcing a new remedy for prevention and treatment of screwworm, states that experiments with the mixture have been so satisfactory that it has been decided to give the formula, which combines diphenylamine and benzol, to the public.

Recommendations for killing screwworms infesting wounds and for protecting susceptible animal tissue against infestation have until recently required the use of one material to kill the maggots in the wound and another to prevent reinfestation. The U. S. Bureau of Entomology and Plant Quarantine, following experiments in 1940 and 1941, announce that they have developed a relatively inexpensive remedy which gives a good or even better protection as materials heretofore recommended.

Known as Formula or Smear No. 62, it consists of a compound of  $3\frac{1}{2}$  parts each by weight of diphenylamine and benzol, 1 part turkey red oil, and 2 parts lampblack.

Smear No. 62 has been applied to wounds on several hundred sheep, goats, and cattle, with no harmful effects. Furthermore, diphenylamine alone applied to sheep and goats developed no ill effects.

To make Smear No. 62: dissolve the diphenylamine in the benzol. Add the oil, and shake thoroughly. Stir lampblack in gradually and continue mixing until the consistency of molasses is reached. Apply with 1-inch paint brush. One gallon will treat 200 to 250 wounds one time.

In Mimeographed Circular E-540, recently issued by the U.S.D.A., Melvin, Smith, Parish, and Barrett state that the mixture should be swabbed well into all the pockets made by the maggots and painted around the wound itself. To protect uninfested wounds caused by shear cuts, castrations, dehorning, and docking, the raw tissues and surrounding areas should be covered with the smear. Since large numbers of the worms drop out of treated wounds, carrying some of the protective chemical with them, a second treatment should be given 24 to 48 hours after the first, followed by treatments twice each week, or oftener where flies are unusually active, until the wound is healed. Where possible, the animals under treatment should be kept in a hospital pasture.

The Department is anxious that the following precautions in preparing and using the smear be observed: (1) Prepare the remedy well away from open flames and do not have lighted cigarettes or cigars around during the process; (2) keep tightly covered in cool place to prevent evaporation of benzol from smear; (3) keep material away from the eyes, mouth, and nostrils of the animal; and (4) do not add oil, grease, or any other substance to the formula or its efficiency will be impaired.

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### Use for Fleece Worms of Sheep

Preliminary tests on sheep show that the smear kills fleece worms, or wool maggots, and gives considerable protection against reinfestation. It is applied to the affected part, and rubbed well into the wool with a brush.

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### NEW CHEMICAL COMPOUND PREVENTS CECAL COCCIDIOSIS EXPERIMENTALLY

Cecal coccidiosis, a disease particularly destructive to chickens, has been effectively prevented experimentally and may eventually be controlled by the use of a chemical compound developed for this purpose by Du Pont.

Cecal coccidiosis is caused by microscopic organisms known as protozoa which invade and attack the cell lining of the cecal pouches of poultry, causing stunting, weakness, and eventual death.

While several sulphur compounds have shown some promise, tetraethyl thiuram monosulfide, when fed experimentally in unadulterated form, appears to be the most satisfactory drug yet tested.

Decision to concentrate further investigation on tetraethyl thiuram monosulfide is based on the results of preliminary experiments conducted at the University of Wisconsin under an industrial grant for research made by the Grasselli Chemicals Department of the Du Pont Company. Eleven sulphur compounds were tried out on White Leghorns, Plymouth Rocks, and Rhode Island Reds. Single doses of tetraethyl thiuram monosulfide, which was least toxic to poultry, prevented development of the disease in the tests. In addition, this compound was found, when administered with coccidia oocysts, to offer considerable promise for producing actual resistance to the malady.

Du Pont scientists emphasize that further experiments are necessary to develop a practical method of application of the chemical in the feed or water to prevent infection or to produce resistance to infection, after which it is hoped to offer the material for general use in the poultry industry.

Used as a preventative, tests conducted so far indicate that tetraethyl thiuram monosulfide does not cure infected poultry. In fact no known drug will kill the disease-producing organism after it penetrates the cells lining the intestinal tract. However, in these experiments, after administration of suitable doses of tetraethyl thiuram monosulfide, it was impossible to infect chickens by direct injection of the disease-causing organisms or by feeding them to the chickens in drinking water.

Use of this new compound, if a satisfactory means of administration is developed, plus the general methods of sanitation usually recommended, should go far toward control of cecal coccidiosis.

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PHENOTHIAZINE FOR REMOVAL OF CECAL WORMS FROM CHICKENS

The following is the first detailed summary of results of rather extensive experiments with phenothiazine to control cecal worms in chickens. This report, originally published in "Veterinary Medicine," Vol. 35, No. 7, is reproduced here by permission of the authors.

By Drs. Ernest C. McCulloch  
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Division of Veterinary Science  
Agricultural Experiment Station  
State College of Washington  
Pullman, Washington

No anthelmintic has been previously reported that would safely and effectively remove the cecal worm, Heterakis gallinae, from poultry. Gildow, Lampman, Moore, and Holm\* stated: "There is no satisfactory general treatment for cecal worms." Graham, Torrey, Mizelle and Michael in their bulletin concluded: "No treatment for cecal worms has proved entirely satisfactory, for the location of these worms makes their complete removal practically impossible." The wide distribution of this parasite, the fact that it causes typhlitis when present in large numbers, and its role as a vector of Histomonas meleagridis, the etiological factor of enterohepatitis or "black-head," make the control of the cecal worm of economic importance.

The reports of Harwood, Jerstad and Swanson, and of others, who successfully used phenothiazine in removing nematode parasites from swine, sheep, and other animals, suggested to the authors the possibility that this drug might be of value as a poultry anthelmintic.

Experimental

A farm flock of heavily parasitized two- to four-year-old S. C. White Leghorn chickens was purchased. These birds were in from poor to fair condition; autopsies of representative birds revealed heavy infestations with cecal worms, moderate infestations with round worms, and variable degrees of infestation with tapeworms. Some of the birds showed evidence of tuberculosis, pullorum disease and leucosis.

The birds were confined in individual, wire-bottomed cages, and the droppings were collected at 24-hour intervals. The fine material was washed from the droppings in a 40-mesh screen and the nematodes collected and counted against a black background, using a brilliant light. Viability was determined by placing the cecal worms in water at 45°C. and observing them for motility. At the

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conclusion of each trial, autopsies were performed and the intestinal contents examined for the presence of parasites by the same method. Identical results were obtained with two lots of phenothiazine; one, a granular powder from the Eastman Kodak Company, and the other, a very fine powder from the E. I. Du Pont Company.

Dosages between 0.05 gm and 1.0 gm were highly effective in killing and removing the cecal worms. Except for birds 386 and 265, which consumed only a small amount of the feed with which the drug had been mixed, the administration of the drug in capsules had only a slight advantage.

Slightly better results were obtained by the administration of repeated doses of phenothiazine than by single doses.

An attempt was made to determine the toxic dose of phenothiazine by administering enormous amounts to experimental chickens. In the first group, four 90-day-old S. C. White Leghorn chickens weighing 907, 907, 1134, and 964 grams were each given 10, 10, 5, and 5 grams respectively of phenothiazine in hard gelatine capsules. Observations were made at frequent intervals, but aside from a slight declination of temperature about six hours after administration, no harmful effect was noted. Appetite and thirst were seemingly unaffected. Subsequent work has shown therapeutic doses of phenothiazine to have no deleterious effect upon the hemoglobin concentration or viability of chickens.

In a later trial five adult S. C. White Leghorn hens weighing 1231, 1316, 1443, 1414, and 1402 grams were given 5, 10, 15, 20, and 25 grams respectively of phenothiazine in hard gelatine capsules. Frequent observations were made. The resulting coloring made its appearance in the droppings one and one-half hours following administration. Fifteen hours after administration the birds were apparently unaffected by the drug except for a slight softening of the droppings. It is interesting to note that the birds that received 15, 20, and 25 grams of the drug voided some of the drug seemingly unaltered in the droppings. Autopsy of the bird that received 25 gm of phenothiazine revealed a severe infestation of heterakids, remaining apparently unaffected in the ceca. This probably was due to sufficient stimulation of the intestinal tract having been produced by the massive dose of the drug so that it was not taken into the ceca. Following autopsy, three days after the administration of this massive dose, this bird was cooked and eaten by its former owner, who reported the flavor of the meat unaffected.

To determine if the drug had a noticeable effect on egg production, two pens of S. C. White Leghorn chickens were given individual capsules. The birds in one pen received 0.5 gm of phenothiazine; the birds in the other pen received empty capsules. Records of egg production made before and after the administration of the drug showed no appreciable difference.

#### Discussion

The data presented reveal that phenothiazine, when used in moderate doses, is a very effective anthelmintic for the removal of cecal worms from chickens. Considerable latitude is possible in the determination of the proper therapeutic

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dose. It is the opinion of the authors that between 0.05 and 0.5 grams per bird is a reasonable amount to recommend. Enormous doses, although harmless to the birds, have little if any effect on the cecal worm. Repeated doses seem to be slightly more efficacious than single doses. It is apparent that birds receiving individual capsule medication are more effectively and surely treated. However, the margin of safety with this drug is so great that flock medication such as the feeding of phenothiazine-treated mash for one day every two weeks appears to be practical. Some of the birds were fasted before administration of the drug; however, there was no noticeable difference in heterakid expulsion or killing power. The use of phenothiazine caused a slight softening of the droppings for approximately 24 to 48 hours. No evidence of enteritis either in the small intestine or ceca was noted on autopsy. Appetite was seemingly unaffected or perhaps slightly increased. Water consumption increased slightly 24 hours following treatment but was not outstanding. Egg production continued normally even in those birds receiving enormous doses.

Although the most desirable dosage of phenothiazine has not as yet been definitely determined, the apparent merits of the drug and its seeming lack of toxicity suggest it as the anthelmintic of choice against Heterakis gallinae. Further work is planned relative to the proper dose, as experimental evidence was obtained that larger doses are effective against ascarids. The cost of phenothiazine is low.

#### Summary

1. Heterakis gallinae is a common parasite of chickens that serves as a vector for Histomonas meleagridis, the causative organism of enterohepatitis. In addition large infestations cause severe typhlitis.
2. Heretofore, no entirely satisfactory anthelmintic for this parasite has been reported. Those previously recommended either are difficult to administer or are low in effectiveness.
3. Phenothiazine was administered to S. C. White Leghorn chickens suffering from a natural heavy infestation of cecal worms. This drug was given either in the feed or in hard gelatine capsules. Single and repeated doses were tried.
4. Between 0.05 and 0.5 grams was found to be a satisfactory individual dose.
5. Repeated doses and administration of the drug in individual capsules were found to be slightly more satisfactory, although flock medication appears to be practical.
6. The average effectiveness was between 95% to 100%, both from the standpoint of cecal worms expelled and killed.
7. Enormous doses, up to 500 times the smallest amount therapeutically effective, had no apparent harmful effect on the birds; such massive doses also had no antiheterakid effect.

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8. Individual capsule medication of 0.5 gm had no appreciable effect on a flock in egg production.

9. Neither massive nor therapeutic doses had any effect upon the flavor of the meat.

10. The administration of phenothiazine was not followed by enteritis or other digestive disturbances, except for a slight softening of the feces 24 hours following treatment.

11. The use of phenothiazine as an anthelmintic for the removal of heterakids is recommended, even though the most desirable dosage has not been definitely determined.

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\* References to reports of investigators mentioned here will be sent on request.

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#### U.S.D.A. RESEARCH CONFIRMS EFFICIENCY OF PHENOTHIAZINE

Research work conducted by the United States Department of Agriculture shows conclusively that phenothiazine is effectively combating injurious and devitalizing internal parasites of livestock. The last annual report of the Secretary of Agriculture states that the findings of investigators of the Bureau of Animal Industry have been confirmed by workers elsewhere in the United States and abroad, "with indications that phenothiazine will become the most valuable treatment yet known for the removal of internal parasites from domestic animals."

Much evidence has also been developed at the various state agricultural experiment stations showing the effectiveness of this chemical in combating internal parasites of poultry, cattle, sheep, goats, horses, swine, and other farm animals.

The Secretary's report says that these investigations with phenothiazine came to fruition near the end of 1940, and that among the parasites which can be controlled by this chemical are stomach worms, hookworms, and nodular worms. It adds:

"The same chemical was found to be the most effective remedy yet discovered for the removal from horses and mules of red or palisade worms and related roundworms, which are as injurious to horses as hookworms are to human beings."

Du Pont chemists, who have spent years in the development of this chemical compound, point out that the Secretary's assertion bears out the action of the American Foundation for Animal Health in including phenothiazine in its list of ten marked discoveries and advances in veterinary science in 1941.

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TIME AND RATE OF NUTRIENT ABSORPTION BY FLUE-CURED TOBACCO

The following is a summary of a paper by A. L. Grizzard, H. R. Davies, and L. R. Kangas, published in the "Journal of the American Society of Agronomy," Vol. 34, No. 4, April, 1942, reprints of which will be sent on request to the Du Pont Agricultural Extension Division. The investigations reported here were made possible through fellowship awards by Du Pont to Virginia Polytechnic Institute.

Experiments have been conducted over a period of two years by the Virginia Agricultural Experiment Station agronomy staff at the branch station at Chatham to determine the time and rate of nutrient absorption by flue-cured tobacco. The investigations developed the following information:

With one exception, differences in yield and value per acre of flue-cured tobacco, due to different fertilizer treatments used, were of doubtful significance. Significant improvement in both yield and value was obtained when one-half of the potash was withheld and used as a side dressing 21 days after the plants were set in the field.

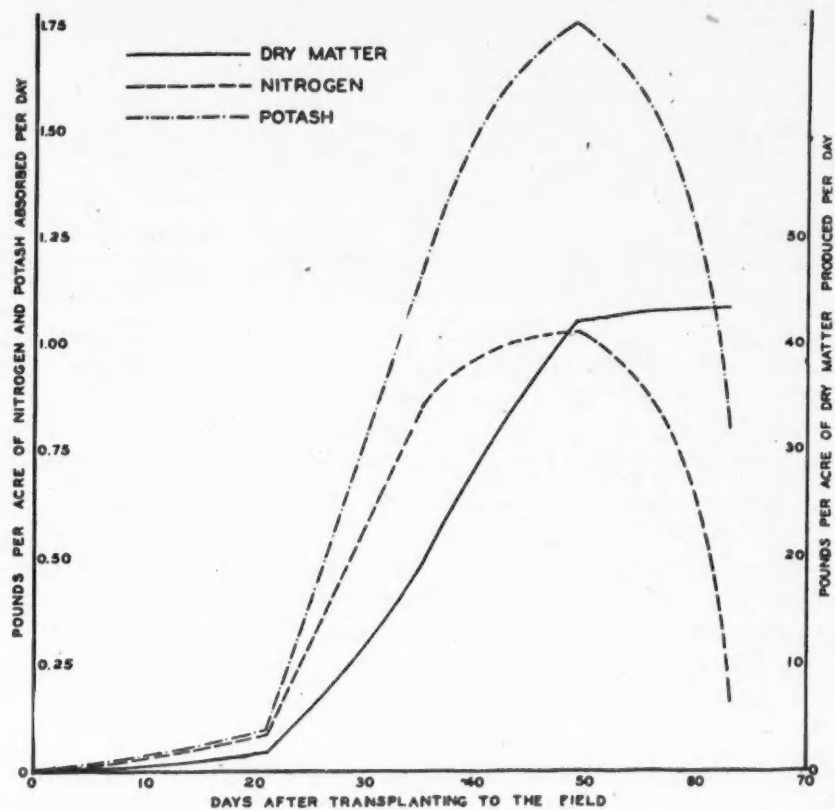
Flue-cured tobacco made only 2.5% of its total growth during the first 3 weeks of a 9-week growth period. Eighty per cent of the growth was made during the last 28 days of a 63-day growing season. The rate of growth increased from 1.8 pounds per acre per day on the 21st day after transplanting to 19.1 pounds per day on the 35th day, and reached a maximum of 43.2 pounds per acre per day when the plants were 63 days old.

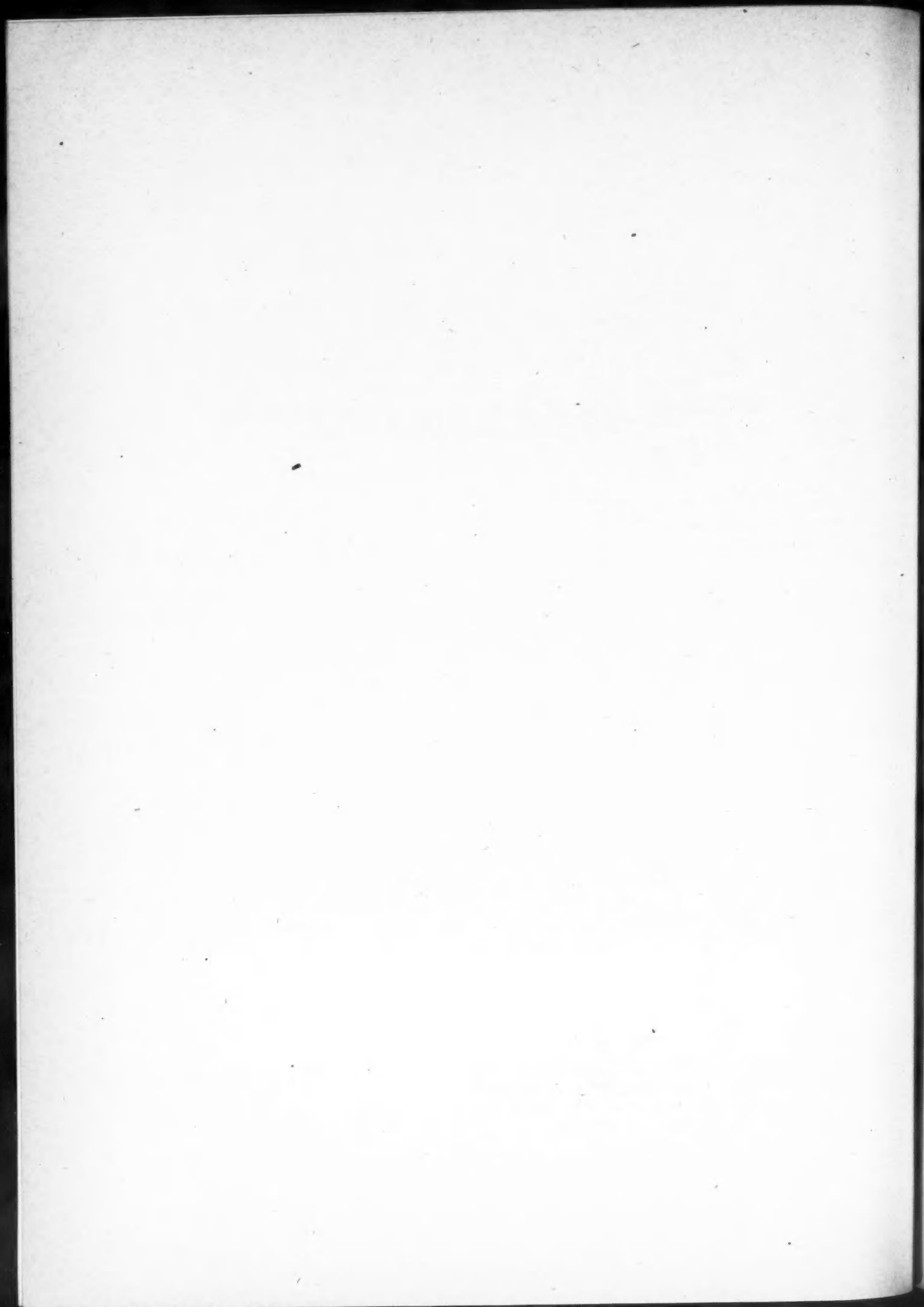
The concentration of soluble nitrogen and phosphoric acid in the plant sap decreased as the growing season advanced. In contrast, the concentration of potash and calcium oxide in the plant sap increased as the plants approached maturity. No definite trend in the concentration of magnesium oxide in the sap was observed.

The composition of flue-cured tobacco varied widely during the different stages of growth. The percentage of nitrogen, phosphoric acid, and potash was very high during the first two intervals of growth, but decreased rapidly as the plants approached maturity. The percentage of calcium and magnesium oxides and sulfur increased rapidly during each of the first three intervals of growth; but during the fourth, there was a slight decrease. Tobacco leaves contained a markedly higher percentage of nitrogen, calcium, and magnesium oxides and sulfur than did the stalks.

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# GROWTH AND RATE OF ABSORPTION OF NITROGEN AND POTASH BY FLUE-CURED TOBACCO





Only a small proportion of the total of each of the different nutrients was absorbed during the first interval of growth. In the third period, the one of greatest absorption, about the same proportion of all six nutrients, 42 to 47% of the totals, was absorbed. Nitrogen absorption was relatively low during the last interval of growth, while the absorption of the other nutrients was high. This emphasizes the importance of maintaining an adequate supply of available nutrients during the latter part of the growing season, with the exception of nitrogen which should be low during the last two weeks of that period.

(See diagram on next page)

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#### HORMONE FRUIT SPRAY HELPS LENGTHEN HARVEST PERIOD

Fruit growers can utilize the findings of science to help solve the wartime farm-labor shortage by use of a Du Pont hormone fruit spray to lengthen the harvest period.

The spray, containing naphthalene acetic acid and known by the trade-mark "Parmone", inhibits the pre-harvest dropping off of fruit for from one to three weeks, depending on weather conditions, thus permitting picking of the crop over a longer period of time and thereby relieving to some extent the critical need for labor during a few rush harvest days or weeks.

Farm-labor committees state that fruit-picking crews will not be available this fall in sufficient numbers to take care of all fruit growers at the same time. However, with a longer picking season which would result from widespread use of the hormone spray, fewer crews would be required to pick the 1942 fruit crops, even though the same number of man-hours was required.

Horticulturists state that because the hormone spray causes the fruit to hang on longer, it develops better color, size, and quality — all important in the production of more and better food for wartime consumption. The percentage of culls is greatly reduced, and losses caused by the normal drop, by heavy winds, and by jarring of the trees while picking are considerably lessened.

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ANNOUNCING APPOINTMENT OF THREE NEW CONSULTANTS

The Du Pont Public Relations Department announces appointment of Gertrude Dieken as home economics consultant, Wilmington, Del.; M. H. Bruner, agricultural consultant for the South, Clemson, S. C.; and V. S. Peterson, agricultural consultant for the Middle West, Ames, Iowa.

For several years the Du Pont Company has furnished speakers for meetings in various parts of the country on subjects relating to chemistry and the farm and farm home. The addition of the consultants will make it possible to accept many more invitations than heretofore.

Persons desiring information on the availability of any of these consultants for lecture-demonstrations should write L. F. Livingston, manager of the Du Pont Agricultural Extension Division, Wilmington, Del.

Biographical notes on each of the new consultants follows.

Gertrude Dieken - Home Economics Consultant

Gertrude Dieken was graduated in journalism from Coe College, Cedar Rapids, Iowa, and has done advanced study in the field of consumer economics and technical journalism at Iowa State College, Ames.

For the last six years, she has been in charge of the home economics information program for the Iowa State College Extension Service, handling press, radio, and public relations, and supervising information programs of county home demonstration agents. Writing homemaking material for farm women has taken her into farm homes all over the state, and has given her interest in and understanding of farm homemakers' problems. She is a native Iowan, lived on an Iowa farm, helps manage the original home farm at the present time, and thus has a first-hand knowledge of rural living.

At Iowa State College, Miss Dieken served as Consumer Editor for the "Iowa Farm Economist and Home Economics" editor for the "Farm Science Reporter." She also wrote home economics copy for a number of farm magazines.

She is vice-president of the American Association of Agricultural College Editors, a member of the American Home Economics Association and, for the last two years, chairman of that organization's committee to promote home economics extension in national publications. Miss Dieken also is a member of the Iowa State Home Economics Association; Theta Sigma Phi and Pi Delta Epsilon, both national journalism honoraries; and Phi Kappa Phi, national scholastic honorary fraternity.

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#### M. H. Bruner - Agricultural Consultant

M. H. Bruner is a graduate in forestry of Pennsylvania State College and of the Yale School of Forestry, from which he received a Master's degree in 1932. During the school years of 1932 and 1933, he took special courses in soils, botany, plant physiology, and pathology in the Yale Graduate School. Beginning in 1934, he worked about three years on land acquisition for national forest purposes for the U. S. Forest Service in North Carolina, Tennessee, and Louisiana. In 1936, he became Extension Forester of the Arkansas Agricultural Extension Service. On January 1, 1939, he took a similar position in South Carolina.

Mr. Bruner, who maintains headquarters at Clemson, S. C., was reared on a Snyder County, Pennsylvania, farm. During the past five years, he has been especially active in developing a greater appreciation for farm forestry in the South. He has written numerous articles for the "Journal of Forestry," "American Forests," and various farm publications.

He is a senior member of the Society of American Foresters, was recently appointed a member of its Committee on Farm Forestry, is vice-chairman of the Appalachian Section of the Society, and is secretary-treasurer of the forestry section of the Association of Southern Agricultural Workers. He is also a member of Xi Sigma Pi, honorary forestry fraternity, and of Gamma Alpha, honorary scientific fraternity.

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#### Vernon S. Peterson - Agricultural Consultant

Vernon S. Peterson is a graduate in agricultural engineering of Kansas State College. Following his graduation, he was extension agricultural engineer at Iowa State College at Ames. In 1933, he was appointed engineering technician and later became acting director of the Iowa U. S. Forest Service CCC camps. He went to Indiana in 1935 as State administrator of the Soil Conservation Service. In 1937, he became Extension agricultural engineer at Pennsylvania State College.

Mr. Peterson, who lives in Ames, Iowa, was reared on a Kansas farm, and still owns and participates in the management of a diversified farm in that state. He is regarded as an authority on farm-building construction and on machinery operation and maintenance, and has had considerable experience in water supply, sewage disposal, electrification, soil and water conservation, land clearing, and drainage. He is author of several publications on agricultural engineering subjects, and has written extensively for the farm press.

Mr. Peterson has served on several committees of the American Society of Agricultural Engineers. He is chairman of its committee on farm and home safety. He is a member of the Pocono Golf Turf Association, the Pennsylvania Potato Growers Cooperative Association, the Vegetable Growers Association of America, and other farm organizations.

